

# INSTALLATION INSTRUCTIONS

## R-410A Single Package Rooftop Heat Pumps

### RHS181 - 243

These instructions must be read and understood completely before attempting installation

### Safety Labeling and Signal Words

#### DANGER, WARNING, CAUTION, and NOTE

The signal words **DANGER**, **WARNING**, **CAUTION**, and **NOTE** are used to identify levels of hazard seriousness. The signal word **DANGER** is only used on product labels to signify an immediate hazard. The signal words **WARNING**, **CAUTION**, and **NOTE** will be used on product labels and throughout this manual and other manual that may apply to the product.

**DANGER** – Immediate hazards which will result in severe personal injury or death.

**WARNING** – Hazards or unsafe practices which could result in severe personal injury or death.

**CAUTION** – Hazards or unsafe practices which may result in minor personal injury or product or property damage.

**NOTE** – Used to highlight suggestions which will result in enhanced installation, reliability, or operation.

#### Signal Words in Manuals

The signal word **WARNING** is used throughout this manual in the following manner:

 **WARNING**

The signal word **CAUTION** is used throughout this manual in the following manner:

 **CAUTION**

#### Signal Words on Product Labeling

Signal words are used in combination with colors and/or pictures or product labels.

### TABLE OF CONTENTS

SAFETY CONSIDERATIONS .....	2
INSTALLATION .....	6
Step 1 – Plan for Unit Location .....	6
Step 2 – Plan for Sequence of Unit Installation ..	7
Step 3 – Inspect Unit .....	7
Step 4 – Provide Unit Support .....	7
Step 5 – Field Fabricate Ductwork .....	10
Step 6 – Rig and Place Unit .....	10
Step 7 – Duct Connection .....	10
Step 8 – Install Outside Air Hood .....	11
Step 9 – Install External condensate Trap & Piping .....	12
Step 10 – Make Electrical Connections .....	13
Step 11 – Adjust Factory-Installed Options .....	19
Step 12 – Install Accessories .....	19
Unit Wire/Fuse or HACR Breaker Sizing Data ...	21
Typical Wiring Diagrams .....	24

 **WARNING**

#### PERSONAL INJURY, AND/OR PROPERTY DAMAGE HAZARD

Failure to carefully read and follow this warning could result in equipment malfunction, property damage, personal injury and/or death.

Installation or repairs made by unqualified persons could result in equipment malfunction, property damage, personal injury and/or death.


The information contained in this manual is intended for use by a qualified service technician familiar with safety procedures and equipped with proper tools and test instruments.

Installation must conform with local building codes and with the national Electrical Code NFPA70 current edition or Canadian Electrical Code part 1 CSA C.22.1.

## SAFETY CONSIDERATIONS

Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock or other conditions which may cause personal injury or property damage. Consult a qualified installer, service agency, or your distributor or branch for information or assistance. The qualified installer or agency must use factory-authorized kits or accessories when modifying this product. Refer to the individual instructions packaged with the kits or accessories when installing.

Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloths for brazing operations and have a fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions attached to the unit. Consult local building codes and appropriate national electrical codes (in USA, ANSI/NFPA70, National Electrical Code (NEC); in Canada, CSA C22.1) for special requirements.

Recognize safety information. This is the safety-alert symbol.  When you see this symbol in instructions or manuals, be alert to the potential for personal injury.

Understand the signal words **DANGER**, **WARNING**, **CAUTION**, and **NOTE**. These words are used with the safety-alert symbol. **DANGER** identifies the most serious hazards which **will** result in serious injury or death. **WARNING** signifies a hazard which **could** result in serious injury or death. **CAUTION** is used to identify unsafe practices which **may** result in minor personal injury or product and property damage. **NOTE** is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

These instructions cover minimum requirements and conform to existing national standards and safety codes. In some instances, these instructions exceed certain local codes and ordinances, especially those that may not have kept up with changing residential construction practices. We require these instructions as a minimum for a safe installation.

### **WARNING**

#### **ELECTRICAL SHOCK HAZARD**

Failure to follow this warning could cause personal injury or death.

Before performing service or maintenance operations on unit, always turn off main power switch to unit and install lockout tag. Unit may have more than one power switch.

### **WARNING**

#### **UNIT OPERATION AND SAFETY HAZARD**

Failure to follow this warning could cause personal injury, death and/or equipment damage.

R-410A refrigerant systems operate at higher pressures than standard R-22 systems. Do not use R-22 service equipment or components on R-410A refrigerant equipment.

### **WARNING**

#### **PERSONAL INJURY AND ENVIRONMENTAL HAZARD**

Failure to follow this warning could cause personal injury or death

Relieve pressure and recover all refrigerant before system repair or final unit disposal.

Wear safety glasses and gloves when handling refrigerants. Keep torches and other ignition sources away from refrigerants and oils.

### **CAUTION**

#### **CUT HAZARD**



Failure to follow this caution may result in personal injury.

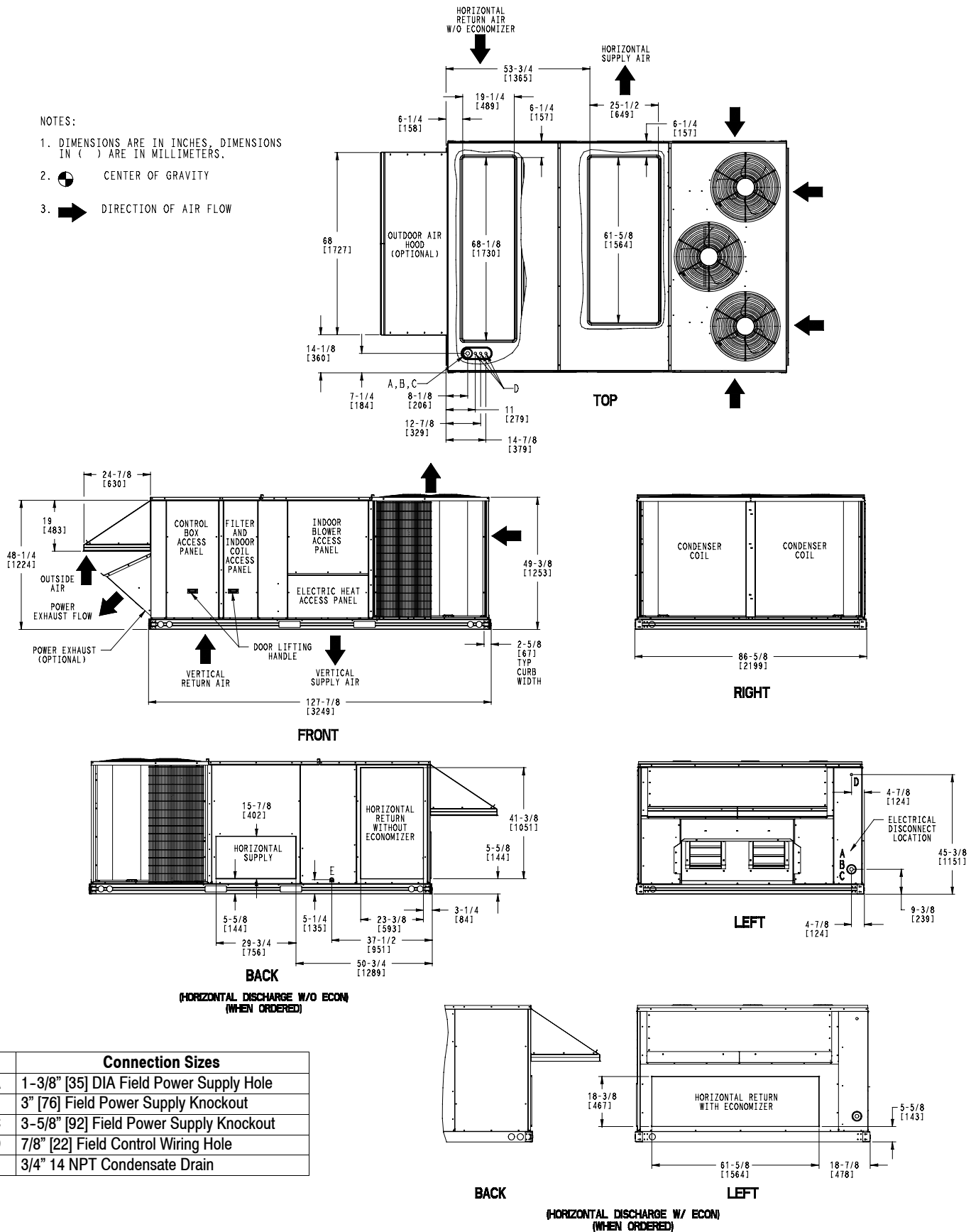
Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing, safety glasses and gloves when handling parts and servicing air conditioning units.

FIGURE 1

RHS Base Unit Dimensions: 15 Ton

NOTES:

1. DIMENSIONS ARE IN INCHES, DIMENSIONS IN ( ) ARE IN MILLIMETERS.
2.  CENTER OF GRAVITY
3.  DIRECTION OF AIR FLOW

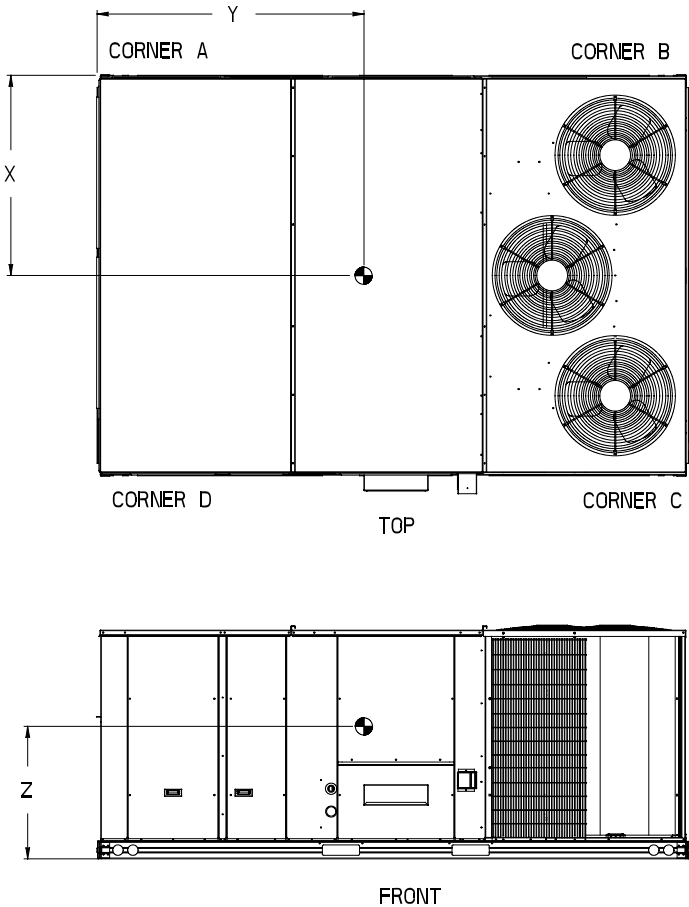


Connection Sizes

A	1-3/8" [35] DIA Field Power Supply Hole
B	3" [76] Field Power Supply Knockout
C	3-5/8" [92] Field Power Supply Knockout
D	7/8" [22] Field Control Wiring Hole
E	3/4" 14 NPT Condensate Drain



Fig. 1 - Unit Dimensional Drawing - 15 Ton

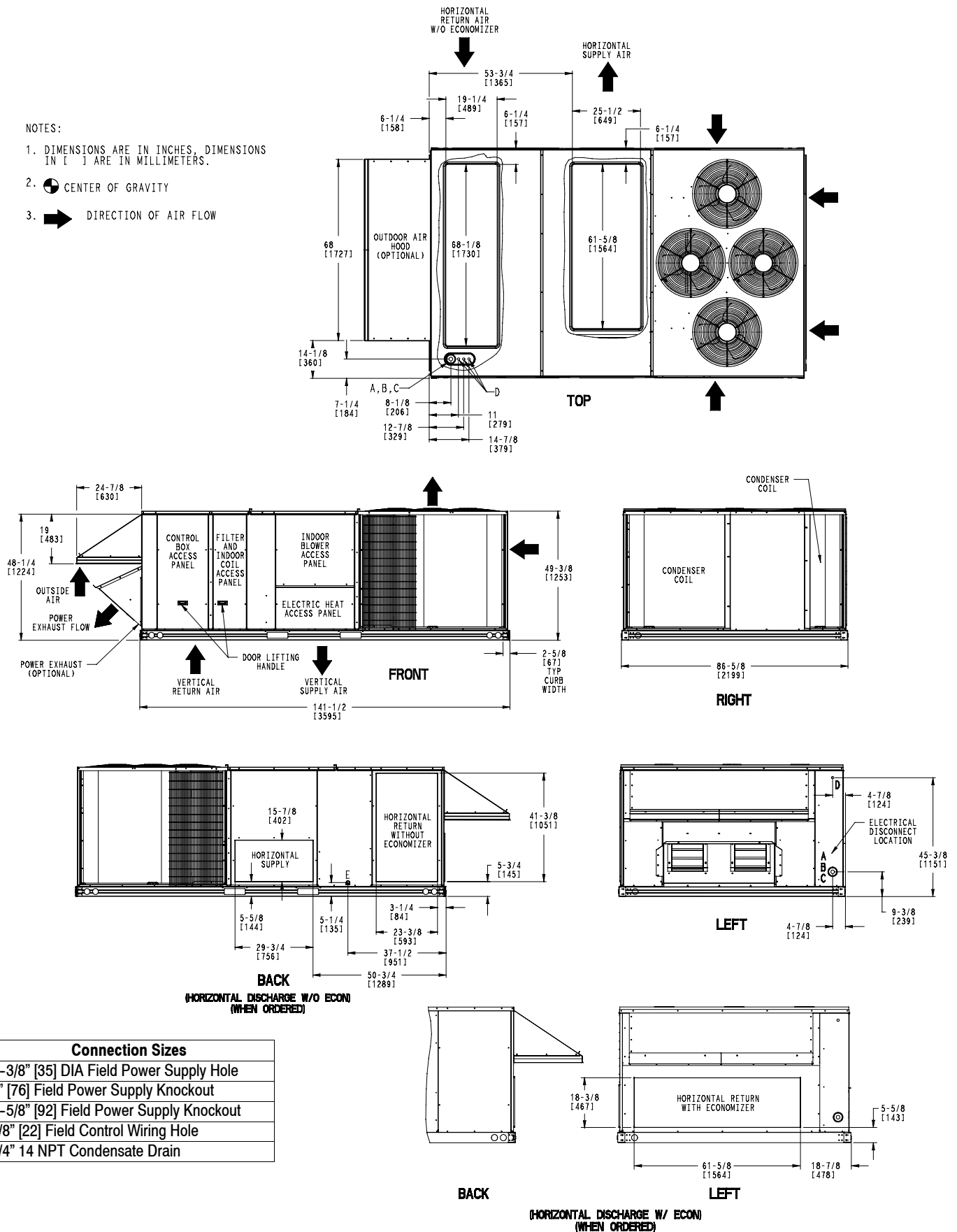
Unit	Size	Base Unit Weight		Corner Weight A		Corner Weight B		Corner Weight C		Corner Weight D		Center of Gravity		
		LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	X	Y	Z
RHS	15 Ton	2156	980	581	264	442	201	489	222	643	292	45-1/4 [1149]	55-1/2 [1405]	16-1/2 [419]



**FIGURE 2 RHS Base Unit Dimensions: 20 Ton**

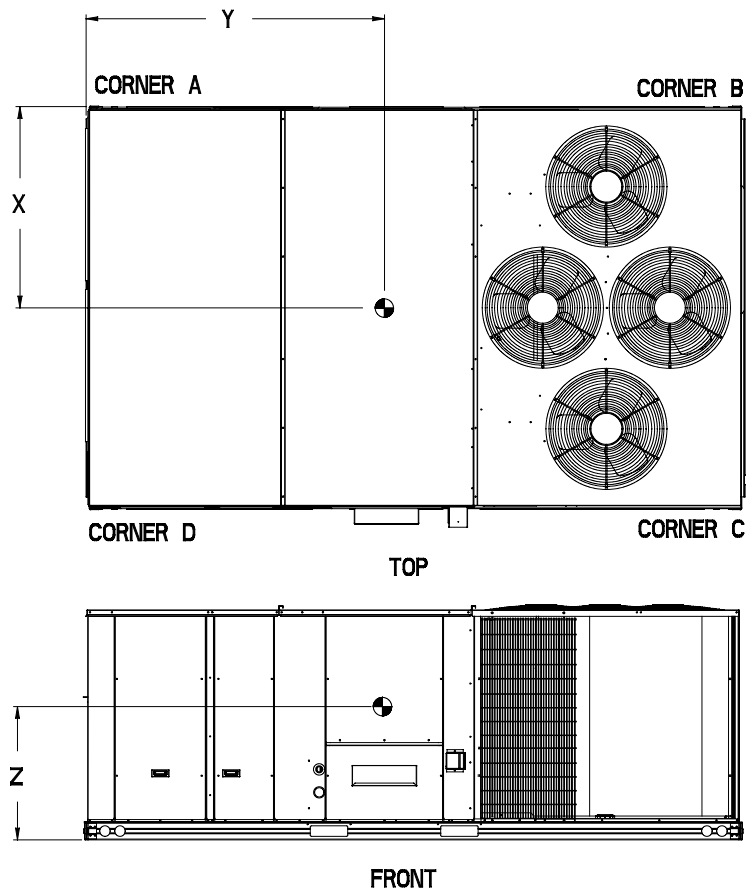
**NOTES:**

1. DIMENSIONS ARE IN INCHES, DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2.  CENTER OF GRAVITY
3.  DIRECTION OF AIR FLOW



**Fig. 2 - Unit Dimensional Drawing - 20 Ton**

Unit	Size	Base Unit Weight		Corner Weight A		Corner Weight B		Corner Weight C		Corner Weight D		Center of Gravity		
		LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	X	Y	Z
RHS	20 Ton	2200	998	633	288	609	277	607	276	631	287	43 [1092]	69-1/2 [1765]	16-1/2 [419]



## INSTALLATION

### Jobsite Survey

Complete the following checks before installation.

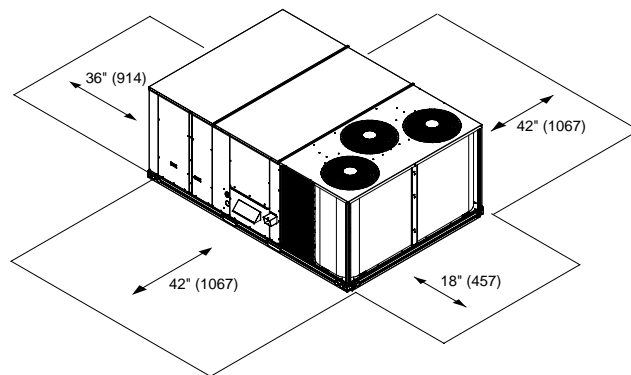
1. Consult local building codes and the NEC (National Electrical Code) ANSI/NFPA 70 for special installation requirements.
2. Determine unit location (from project plans) or select unit location.
3. Check for possible overhead obstructions which may interfere with unit lifting or rigging.

### Step 1 — Plan for Unit Location

Select a location for the unit and its support system (curb or other) that provides for the minimum clearances required for safety. This includes the clearance to combustible surfaces, unit performance and service access below, around and above unit as specified in unit drawings. See Fig. 3.

**FIGURE 3**

**Service Clearance Dimansional Drawing**



**NOTE:** Consider also the effect of adjacent units.

Unit may be installed directly on wood flooring or on Class A, B, or C roof-covering material when roof curb is used.

Do not install unit in an indoor location. Do not locate air inlets near exhaust vents or other sources of contaminated air.

Although unit is weatherproof, avoid locations that permit water from higher level runoff and overhangs to fall onto the unit.

Select a unit mounting system that provides adequate height to allow installation of condensate trap per requirements. Refer to Step 9 — Install External Trap for Condensate Drain — for required trap dimensions.

**Roof mount —**

Check building codes for weight distribution requirements. Unit operating weight is shown in Table 1.

**Step 2 — Plan for Sequence of Unit Installation**

The support method used for this unit will dictate different sequences for the steps of unit installation. For example, on curb-mounted units, some accessories must be installed on the unit before the unit is placed on the curb. Review the following for recommended sequences for installation steps.

**Curb-mounted installation —**

- Install roof curb
- Install field-fabricated ductwork inside curb
- Install accessory thru-base service connection package, if used, (affects curb and unit)
- Rig and place unit
- Remove top skid
- Install condensate line trap and piping
- Make electrical connections
- Install other accessories

**Pad-mounted installation —**

- Prepare pad and unit supports
- Rig and place unit
- Remove duct covers and top skid
- Install field-fabricated ductwork at unit duct openings
- Install condensate line trap and piping
- Make electrical connections
- Install other accessories

**Frame-mounted installation —**

Frame-mounted applications generally follow the sequence for a curb installation. Adapt as required to suit specific installation plan.

**Step 3 — Inspect unit**

Inspect unit for transportation damage. File any claim with transportation agency.

Confirm before installation of unit that voltage, amperage and circuit protection requirements listed on unit data plate agree with power supply provided.

**Step 4 — Provide Unit Support**

**Roof Curb Mount —**

Accessory roof curb details and dimensions are shown in Fig. 4 (15 ton units) and Fig. 5 (20 ton units). Assemble and install accessory roof curb in accordance with instructions shipped with the curb.

**NOTE:**The gasketing of the unit to the roof curb is critical for a watertight seal. Install gasket supplied with the roof curb as shown in Fig. 4 and Fig. 5. Improperly applied gasket can also result in air leaks and poor unit performance.

Curb should be level. This is necessary for unit drain to function properly. Unit leveling tolerances are show in Fig. 6. Refer to Accessory Roof Curb Installation Instructions for additional information as required.

Install insulation, cant strips, roofing felt, and counter flashing as shown. *Ductwork must be attached to curb and not to the unit. The accessory thru-the-base power and gas connection package must be installed before the unit is set on the roof curb.*

If electric and control wiring is to be routed through the basepan remove knockouts in basepan located in control box area, see Fig. 7 for location. Attach the service connections to the basepans.

**Slab Mount (Horizontal Units Only) —**

Provide a level concrete slab that extends a minimum of 6 in. (150 mm) beyond unit cabinet. Install a gravel apron in front of condenser coil air inlet to prevent grass and foliage from obstructing airflow.

**NOTE:**Horizontal units may be installed on a roof curb if required.

**Alternate Unit Support (In Lieu of Curb or Slab Mount) —**

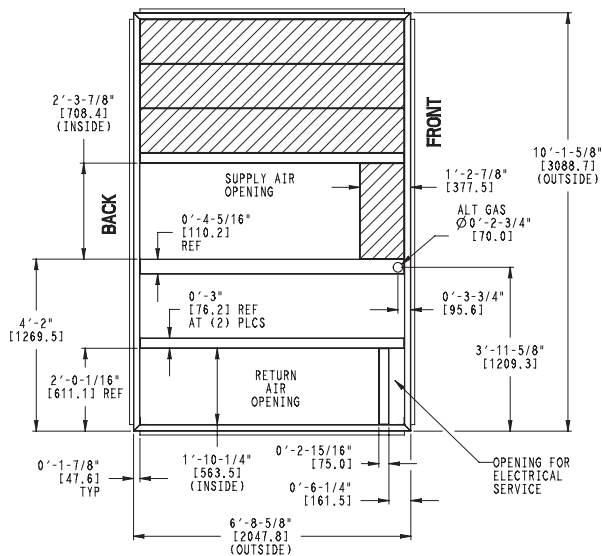
A non-combustible sleeper rail can be used in the unit curb support area. If sleeper rails cannot be used, support the long sides of the unit with a minimum of 4 equally spaced 4-in. x 4-in. (102 mm x 102 mm) pads on each side. Locate pads so that they support the rails. Make sure to avoid the fork openings.

**Table 1—Operating Weights**

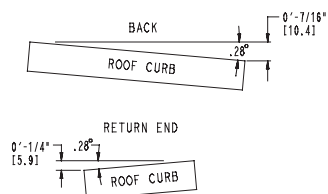
Component	UNITS LB (KG)	
	15 Ton	20 Ton
Base Unit	2035 [923]	2200 [998]
Economizer	245 [111]	245 [111]
Curb		
14-in/356 mm	243 [111]	273 [124]
24-in/610 mm	315 [143]	350 [159]

**FIGURE 4**      **Roof Curb Details RHS**

RoofCurb Accessory	A	Unit Size
CRRFCURB045A00	1' 2" [356]	15 Ton
CRRFCURB046A00	2' 0" [610]	



- NOTES:
- 1 ROOF CURB ACCESSORY IS SHIPPED UNASSEMBLED.
  - 2 DIMENSIONS IN [ ] ARE IN MILLIMETERS.
  - 3 ROOF CURB GALVANIZED STEEL.
  - 4 ATTACH DUCTWORK TO CURB (FLANGES ON DUCT REST ON CURB)
  - 5 SERVICE CLEARANCE 4 ft ON EACH SIDE
- ➔ DIRECTION OF AIR FLOW



MAX CURB LEVELING TOLERANCES

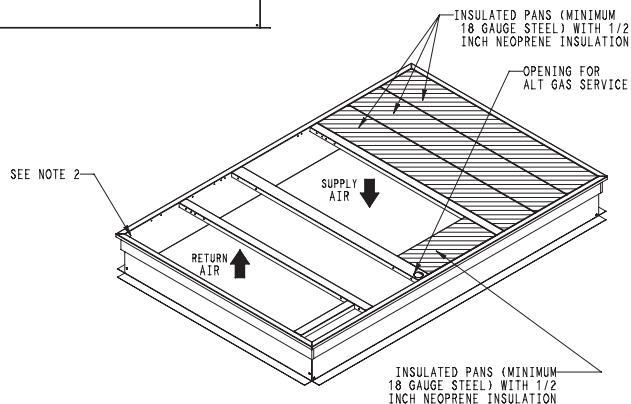
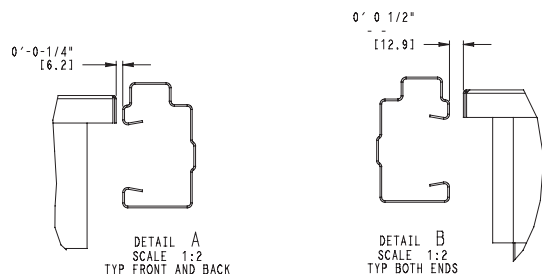
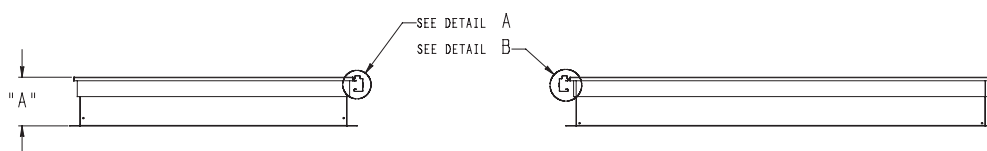
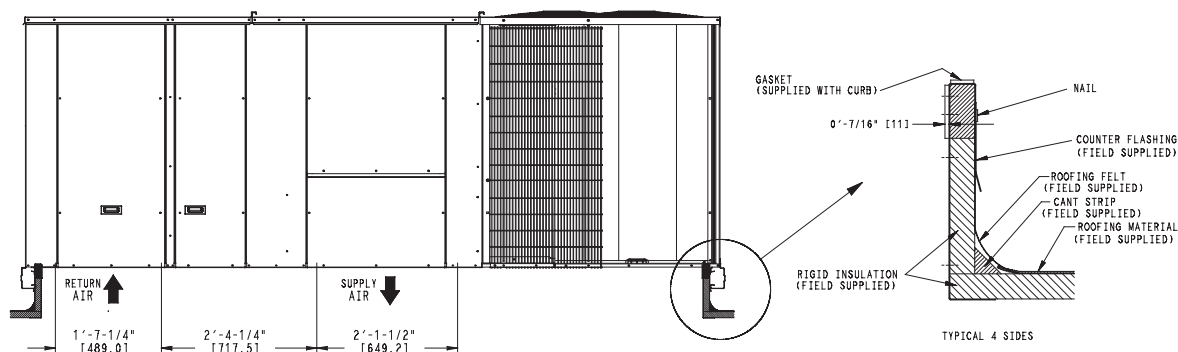
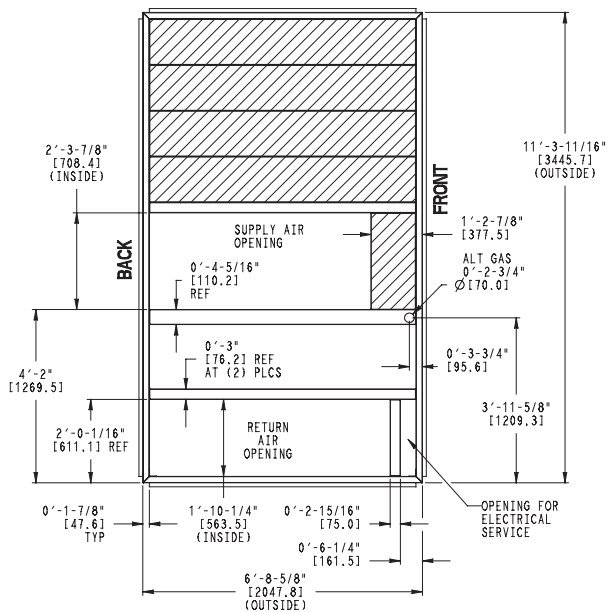




FIGURE 5

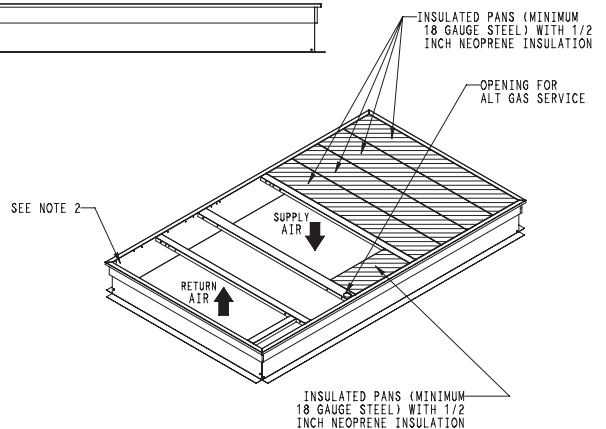
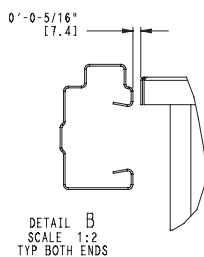
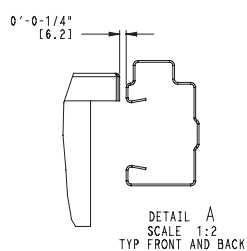
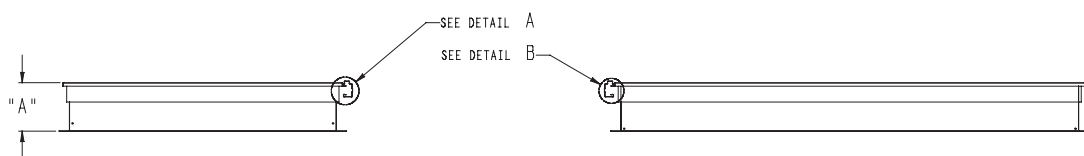
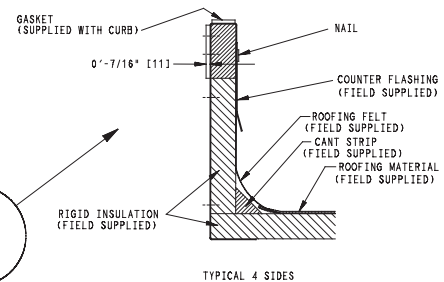
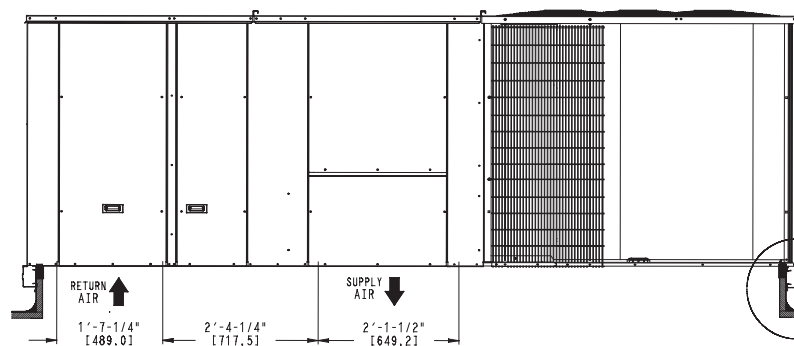
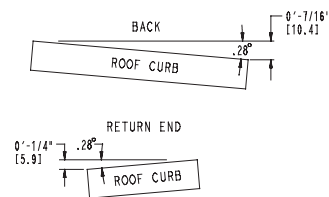
Roof Curb Details RHS

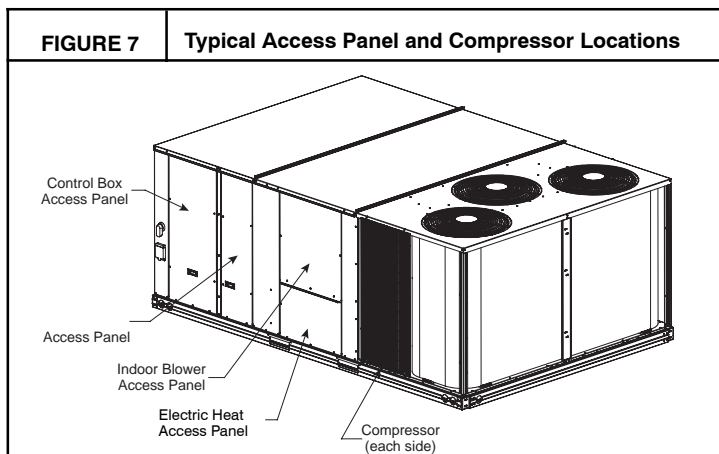
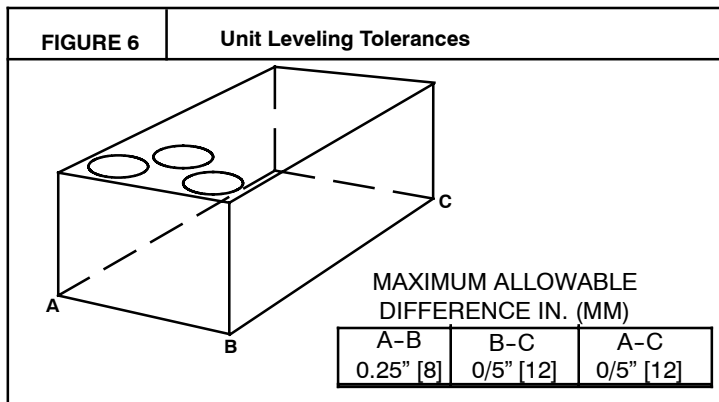
RoofCurb Accessory	A	Unit Size
CRRFCURB047A00	1' 2" [356]	20 Ton
CRRFCURB048A00	2' 0" [610]	



- NOTES:
- 1 ROOF CURB ACCESSORY IS SHIPPED UNASSEMBLED.
  - 2 DIMENSIONS IN [ ] ARE IN MILLIMETERS.
  - 3 ROOF CURB GALVANIZED STEEL.
  - 4 ATTACH DUCTWORK TO CURB (FLANGES ON DUCT REST ON CURB)
  - 5 SERVICE CLEARANCE 4 ft ON EACH SIDE

➔ DIRECTION OF AIR FLOW





### Step 5 — Field Fabricate Ductwork

Cabinet return-air static pressure (a negative condition) shall not exceed 0.5 in. wg (87 Pa) with economizer or without economizer.

For vertical ducted applications, secure all ducts to roof curb and building structure. *Do not connect ductwork to unit.*

Insulate and weatherproof all external ductwork, joints, and roof openings with counter flashing and mastic in accordance with applicable codes.

Ducts passing through unconditioned spaces must be insulated and covered with a vapor barrier.

If a plenum return is used on a vertical unit, the return should be ducted through the roof deck to comply with applicable fire codes.

For units with accessory electric heaters, a minimum clearance is not required around ductwork. One inch (25 mm) clearance to combustible materials must be maintained for the first 48 inches (1220 mm) of ductwork exiting the unit. This applies to horizontal and vertical applications.

Outlet grilles must not lie directly below unit discharge.

**NOTE:** A 90-degree elbow must be provided in the ductwork to comply with UL (Underwriters Laboratories) code for use with electric heat.

## ⚠ WARNING

### PERSONAL INJURY AND ENVIRONMENTAL HAZARD

Failure to follow this warning could cause personal injury. For vertical supply and return units, tools or parts could drop into ductwork and cause an injury. Install a 90-degree turn in the return ductwork between the unit and the conditioned space. If a 90-degree elbow cannot be installed, then a grille of sufficient strength and density should be installed to prevent objects from falling into the conditioned space. Due to electric heater, supply duct will require 90-degree elbow.

### Step 6 — Rig and Place Unit

Keep unit upright and do not drop. Spreader bars are not required if top crating is left on unit. Rollers may be used to move unit across a roof. Level by using unit frame as a reference. See Table 1 and Fig. 6 for additional information.

Lifting holes are provided in base rails as shown in Fig. 6. Refer to rigging instructions on unit.

## ⚠ CAUTION

### UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage.

All panels must be in place when rigging. Unit is not designed for handling by fork truck.

Before setting the unit onto the curb, recheck gasketing on curb.

### Positioning on Curb —

Position unit on roof curb so that the following clearances are maintained: 1/4 in. (6.4 mm) clearance between the roof curb and the base rail inside the front and rear, 1/2 in. (12mm) clearance between the roof curb and the base rail inside on the front and back. This will result in the distance between the roof curb and the base rail inside on the condenser end of the unit being approximately equal to Detail A in Figs. 4 & 5.

Do not attempt to slide unit on curb after unit is set. Doing so will result in damage to the roof curb seal.

Although unit is weatherproof, guard against water from higher level runoff and overhangs.

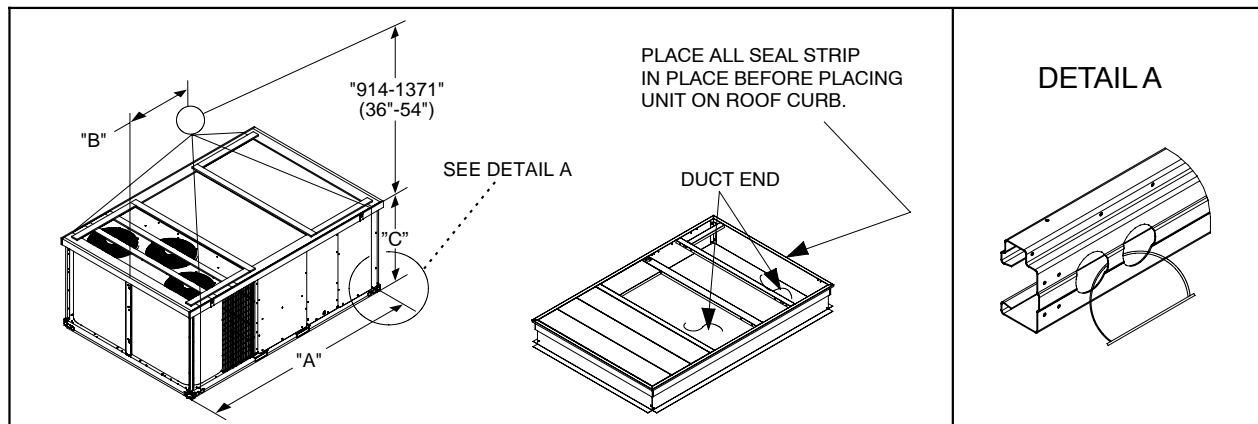
After unit is in position, remove rigging skids and shipping materials.

### Step 7 — Duct Connection

Field-supplied (3/4-inch) flanges should be attached to horizontal duct openings (see Fig. 9) and all ductwork should be secured to the flanges. Insulate and weatherproof all external ductwork, joints, and roof or building openings with counter flashing and mastic in accordance with applicable codes.

FIGURE 8

## Rigging Details



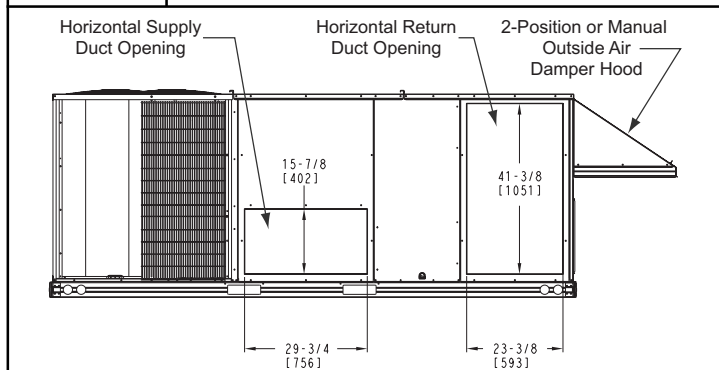
UNIT Size	MAX WEIGHT		DIMENSIONS					
			A		B		C	
	LB	KG	IN	MM	IN	MM	IN	MM
15 Ton	2070	940	127.8	3248	58.7	1491	52.3	1328
20 Ton	2358	1071	141.5	3595	58.7	1491	52.3	1328

## NOTES:

1. Dimensions in ( ) are in millimeters.
2. Hook rigging shackles through holes in base rail, as shown in detail "A." Holes in base rails are centered around the unit center of gravity. Use wooden top to prevent rigging straps from damaging unit.

FIGURE 9

## Horizontal Duct Opening Dimensions



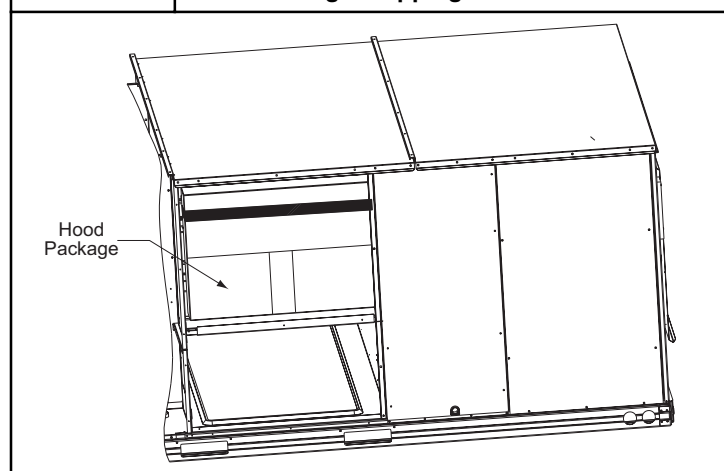
## Step 8 — Install Optional Outside Air Hood

## Economizer and Two Position Hood Removal - Factory Option

1. The hood is shipped in knock--down form and is located in the indoor air compartment. The hood is strapped to the blower assembly. (See Fig. 10)

FIGURE 10

## Hood Package Shipping Locations

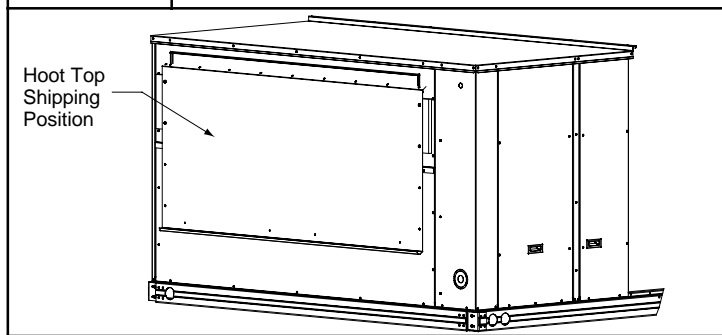


2. To gain access to the hood, remove the back blower access panel.
3. Locate and cut the strap, being careful to not damage any wiring.
4. Carefully lift the hood assembly through the back blower access opening and assemble per the steps outlined in the following procedure.

## Two Position Damper and Economizer Hood Installation - Factory Option

1. Remove hood top from shipping position. (See Fig. 11.)

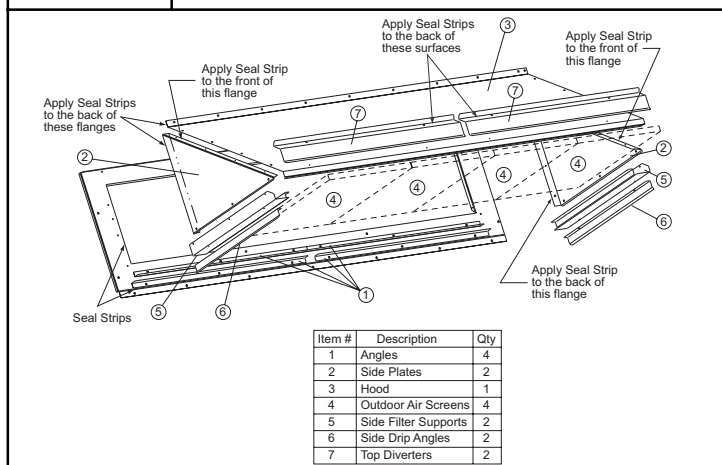
**FIGURE 11 Hood Top Shipping Position**



See Fig. 12 for identification of the various parts of the hood assembly.

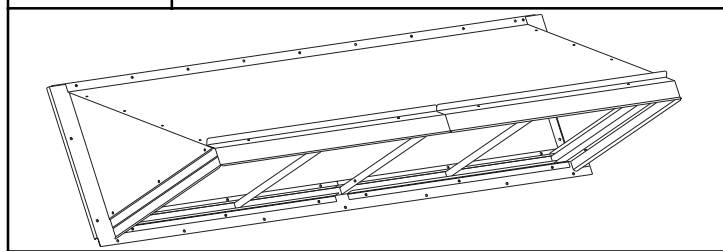
2. Install four angles to the upper end panel using the screws provided
3. Apply seal strip to mating flanges on the side plates of the hood (see Fig. 12).

**FIGURE 12 Seal Strip Application Areas**



4. Secure side plates to panel using the screws provided.
5. Apply seal strip to mating flange of the hood (see Fig. 12).
6. On 15 and 20 ton units, remove screws across top cover. Attach hood to side plates. (these units, flange will slide behind flange of top cover.)
7. On 15 and 20 ton units, secure the top flange using the screws removed in step 6.
8. Install outdoor air screens by sliding them into the channel formed by the four angles installed in step 2. Make sure that the screens extend across the entire length of the hood.
9. Install side filter supports using the screws provided.
10. Install side drip angles using the screws provided.
11. Run a continuous length of seal strip across the hood covering the engagement holes in the lower hood.
12. Install top diverter using the screws provided.
13. On units with barometric relief, remove screws at bottom of relief damper. **Do not discard damper door.**

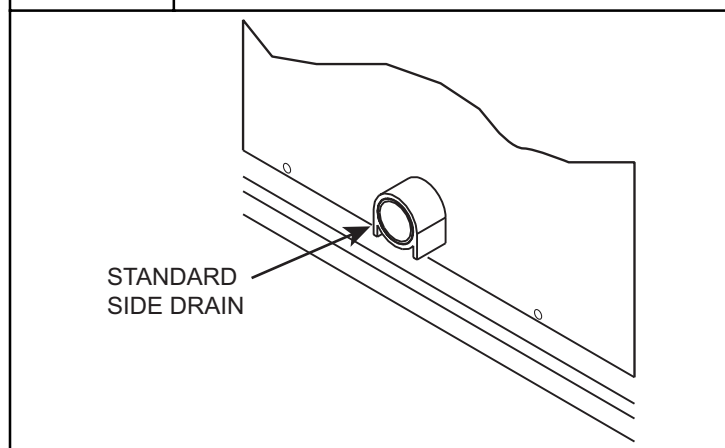
**FIGURE 13 Hood Assembly - Completed**



### Step 9 — Install External Condensate Trap and Line

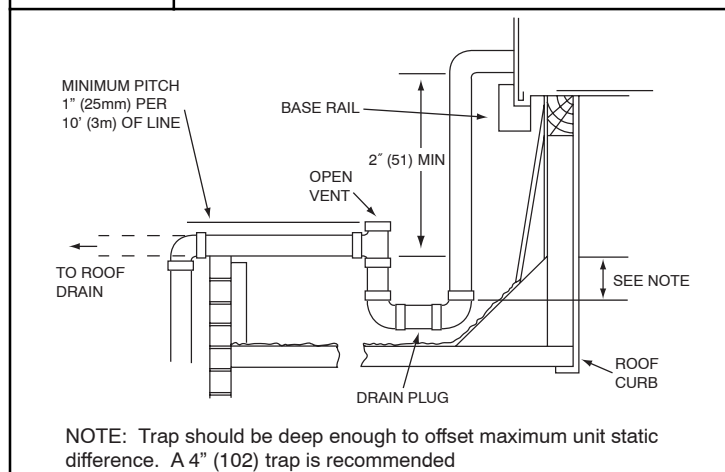
The unit has one  $\frac{3}{4}$ -in. condensate drain connection on the end of the condensate pan (see Fig. 14) See Fig. 1 (or Fig. 2), item “E”, in the view labeled “BACK (HORIZONTAL DISCHARGE)” for the location of the condensate drain connection.

**FIGURE 14 Condensate Drain Pan Connection**



The piping for the condensate drain and external trap can be completed after the unit is in place. Hand tighten fittings to the drain pan fitting. Provide adequate support for the drain line. Failure to do so can result in damage to the drain pan. See Fig. 15.

**FIGURE 15 Condensate Drain Piping Details**



*All units must have an external trap for condensate drainage. Install a trap at least 4-in. (102 mm) deep and protect against freeze-up. If drain line is installed downstream from the external trap, pitch the line away from the unit at 1-in. per 10 ft (25 mm in 3 m) of run. Do not use a pipe size smaller than the unit connection ( $\frac{3}{4}$ -in.).*

## Step 10 — Make Electrical Connections



### WARNING

#### ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

*Do not use gas piping as an electrical ground.* Unit cabinet must have an uninterrupted, unbroken electrical ground to minimize the possibility of personal injury if an electrical fault should occur. This ground may consist of electrical wire connected to unit ground lug in control compartment, or conduit approved for electrical ground when installed in accordance with NEC (National Electrical Code); ANSI/NFPA 70, latest edition (in Canada, Canadian Electrical Code CSA [Canadian Standards Association] C22.1), and local electrical codes.

**NOTE:** Check all factory and field electrical connections for tightness. Field-supplied wiring shall conform with the limitations of 63°F (33°C) rise.

#### Field Power Supply —

Field power wires are connected to the unit at line-side pressure lugs on the terminal block (see wiring diagram label for control box component arrangement) or at factory-installed option non-fused disconnect switch. Use copper conductors only.

**NOTE:** Make field power connections directly to line connection pressure lugs only.

All units except 208/230-v units are factory wired for the voltage shown on the nameplate. *If the 208/230-v unit is to be connected to a 208-v power supply, the control transformer must be rewired by moving the black wire with the 1/4-in. female spade connector from the 230-v connection and moving it to the 208-v 1/4-in. male terminal on the primary side of the transformer.* Refer to unit label diagram for additional information.



### WARNING

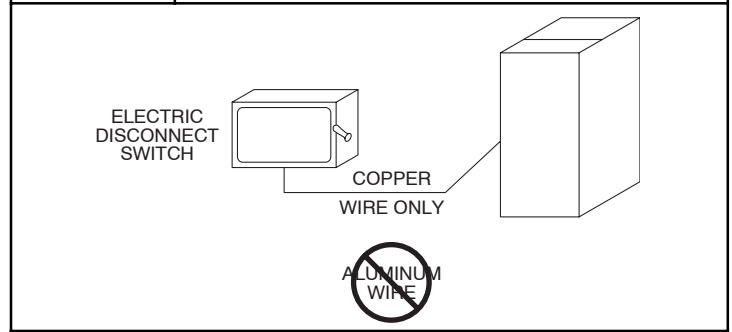
#### FIRE HAZARD

Failure to follow this warning could result in intermittent operation or performance satisfaction.

Do not connect aluminum wire between disconnect switch and furnace. Use only copper wire. (See Fig. 16.)

FIGURE 16

Disconnect Switch Unit



#### Units Without Factory-Installed Disconnect —

When installing units, provide a disconnect switch per NEC (National Electrical Code) of adequate size. Disconnect sizing data is provided on the unit informative plate. Locate on unit cabinet or within sight of the unit per national or local codes. Do not cover unit informative plate if mounting the disconnect on the unit cabinet.

#### Units with Factory-Installed Disconnect —

The factory-installed option disconnect switch is located in the main control box. The manual switch handle is accessible on the corner post adjacent to the control box access panel.

#### All units -

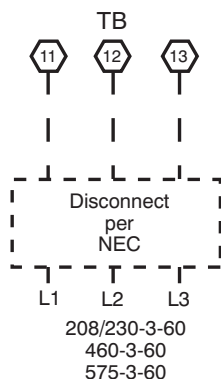
All field wiring must comply with NEC and all local codes. Size wire based on MCA (Minimum Circuit Amps) on the unit informative plate. See Fig. 17 for power wiring connections to the unit power terminal block and equipment ground.

Provide a ground-fault and short-circuit over-current protection device (fuse or breaker) per NEC Article 440 (or local codes). Refer to unit informative data plate for MOCP (Maximum Over-current Protection) device size.

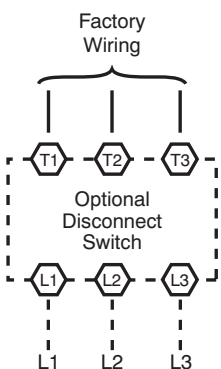
All field wiring must comply with the NEC and local requirements.

**FIGURE 17 Power Wiring Connections**

### Units Without Disconnect Option



### Units With Disconnect Option



### Convenience Outlets —

## ⚠ WARNING

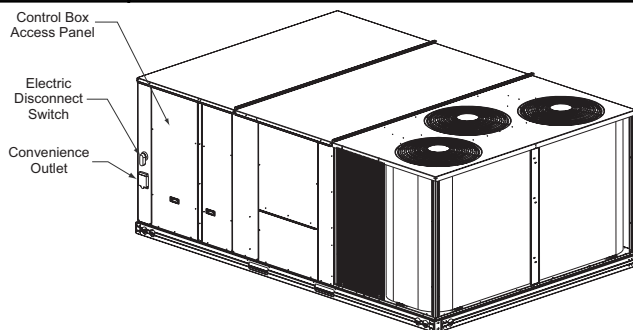
### ELECTRICAL OPERATION HAZARD

Failure to follow this warning could result in personal injury or death.

Units with convenience outlet circuits may use multiple disconnects. Check convenience outlet for power status before opening unit for service. Locate its disconnect switch, if appropriate, and open it. Tag-out this switch, if necessary.

An optional non-powered convenience outlet is offered on all models that provide a 125-volt GFCI (ground-fault circuit-interrupter) duplex receptacle rated at 15-A behind a hinged access cover, located on the corner panel of the unit. See Fig. 18.

**FIGURE 18 Convenience Outlet Location**



### Installing Weatherproof Cover —

A weatherproof while-in-use cover for the factory-installed convenience outlets is now required by UL standards. This cover cannot be factory-mounted due its depth; it must be installed at unit installation. For shipment, the convenience outlet is covered with a blank cover plate.

The weatherproof cover kit is shipped in the unit's control box. The kit includes the hinged cover, a backing plate and gasket.

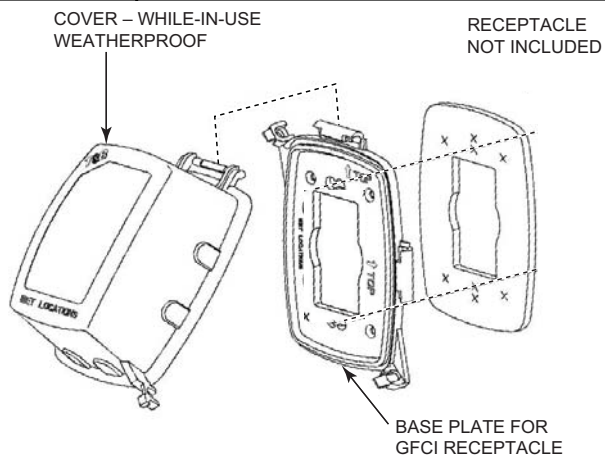
**DISCONNECT ALL POWER TO UNIT AND CONVENIENCE OUTLET.**

Remove the blank cover plate at the convenience outlet; discard the blank cover.

Loosen the two screws at the GFCI duplex outlet, until approximately  $\frac{1}{2}$ -in (13 mm) under screw heads are exposed. Press the gasket over the screw heads. Slip the backing plate over the screw heads at the keyhole slots and align with the gasket; tighten the two screws until snug (do not over-tighten).

Mount the weatherproof cover to the backing plate as shown in Fig. 19. Remove two slot fillers in the bottom of the cover to permit service tool cords to exit the cover. Check for full closing and latching.

**FIGURE 19 Weatherproof Cover Installation**





**Non-powered type:** This type requires the field installation of a general-purpose 125-volt 15-A circuit powered from a source elsewhere in the building. Observe national and local codes when selecting wire size, fuse or breaker requirements and disconnect switch size and location. Route 125-v power supply conductors into the bottom of the utility box containing the duplex receptacle.

Test the GFCI receptacle by pressing the TEST button on the face of the receptacle to trip and open the receptacle. Check for proper grounding wires and power line phasing if the GFCI receptacle does not trip as required. Press the RESET button to clear the tripped condition.

**Fuse on power type:** The factory fuse is a Bussman FNQ-7 dual element time delay fuse.

**Using unit-mounted convenience outlets:** Units with unit-mounted convenience outlet circuits will often require that two disconnects be opened to de-energize all power to the unit. Treat all units as electrically energized until the convenience outlet power is also checked and de-energization is confirmed. Observe National Electrical Code Article 210, Branch Circuits, for use of convenience outlets.

#### **Thru-Base Connections —**

All units are equipped with the ability to bring utilities through the base.

The electrical entrance is located in the control box area can be accessed through the control box access panel. An embossed area is provided with three knock outs. High voltage is brought through the multi knock out by removing the appropriate size for the size of the fitting required. A 7/8-in. knock out is provided for low voltage. An additional 7/8-in. knock out is provided for a 115 volt line which is used when the unit is equipped with the non-powered convenience outlet option.

All required fittings are field supplied. Install fittings when access to both top and bottom of the base pan is available.

#### **Field Installation of Thru-Base Connections —**

1. Install conduit, liquid tight, between disconnect and control box.
2. Pull correctly rated high voltage wires through the conduit.
3. Install power lines to terminal connections as shown in Fig. 17.

#### **All Units —**

Voltage to compressor terminals during operation must be within voltage range indicated on unit nameplate. On 3-phase units, voltages between phases must be balanced within 2% and the current within 10%. Use the following formula to determine the percent of voltage imbalance.

$$\% \text{ Voltage Imbalance} = 100 \times \frac{\text{max voltage deviation from average voltage}}{\text{average voltage}}$$

Operation on improper line voltage or excessive phase imbalance constitutes abuse and may cause damage to electrical components. Such operation would invalidate any applicable warranty.

#### **Field Control Wiring —**

The RHS unit requires a field-supplied commercial grade programmable (occupied and unoccupied setpoints) external temperature control device.

#### **Thermostat —**

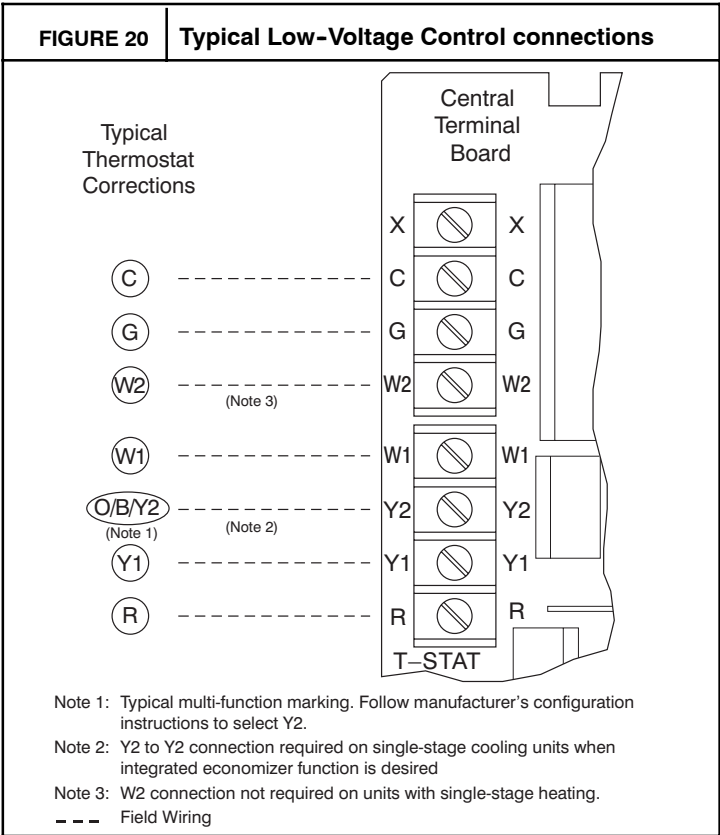
Install a commercial grade 2-stage thermostat according to installation instructions included with the accessory. Locate the field supplied thermostat accessory on a solid wall in the conditioned space to sense average temperature in accordance with the thermostat installation instructions.

If the thermostat contains a logic circuit requiring 24-v power, use a thermostat cable or equivalent single leads of different colors with minimum of seven leads. If the thermostat does not require a 24-v source (no "C" connection required), use a thermostat cable or equivalent with minimum of six leads. Check the thermostat installation instructions for additional features which might require additional conductors in the cable.

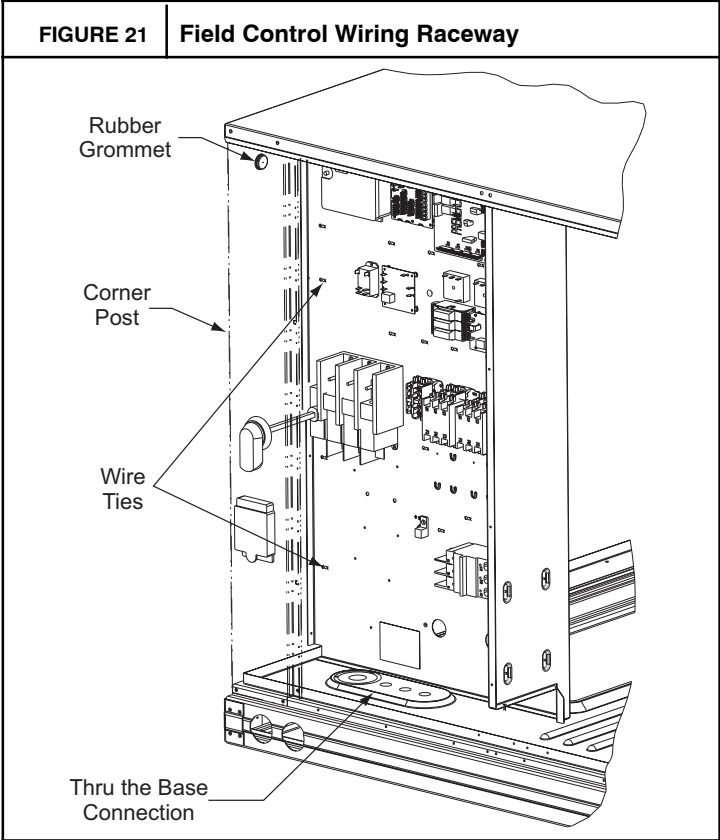
For wire runs up to 50 ft. (15 m), use no. 18 AWG (American Wire Gage) insulated wire (35°C minimum). For 50 to 75 ft. (15 to 23 m), use no. 16 AWG insulated wire (35°C minimum). For over 75 ft. (23 m), use no. 14 AWG insulated wire (35°C minimum). All wire sizes larger than no. 18 AWG cannot be directly connected to the thermostat and will require a junction box and splice at the thermostat.

#### **Low Voltage Wire Routing —**

Correctly rated low voltage wire can be routed through the rubber grommet located on the corner post adjacent to the control box access panel. Route wire through the grommet and then route the wire behind the corner post utilizing the factory provided wire ties secured to the control box. This will insure separation of the field low voltage wire and the high voltage circuit. Route the low voltage wire to the central terminal board. See Fig. 20.



**NOTE:**If utilizing the through the base connections, route the low voltage wire through the wire ties to the central terminal board.



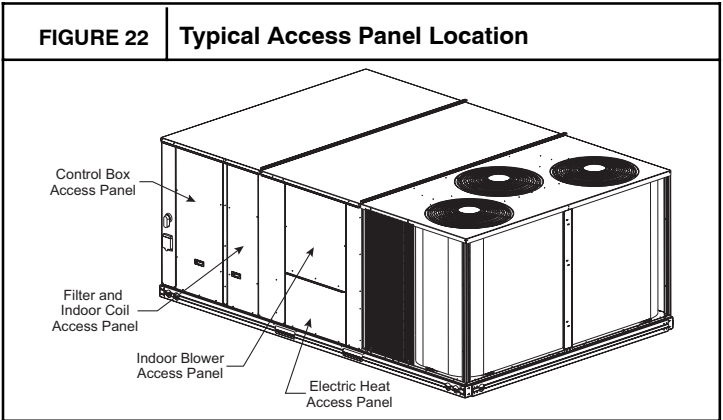
### Heat Anticipator Settings —

Set heat anticipator settings at 0.14 amp for the first stage and 0.14 amp for second-stage heating, when available.

### Electric Heaters

RHS units may be equipped with field-installed accessory electric heaters. The heaters are modular in design, with heater frames holding open coil resistance wires strung through ceramic insulators, line-break limit switches and a control contactor.

Heater modules are installed in the compartment below the indoor blower access panel. Access is through the electric heat access panel. Heater modules slide into the compartment on tracks along the bottom of the heater opening. See Fig. 22, Fig. 23 and Fig. 24. Refer to the Electric Heater Kit Installation Instructions for complete details.

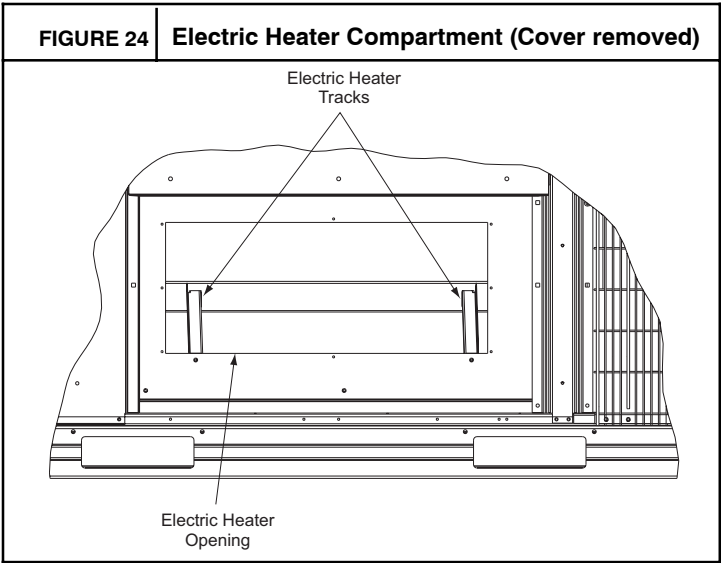
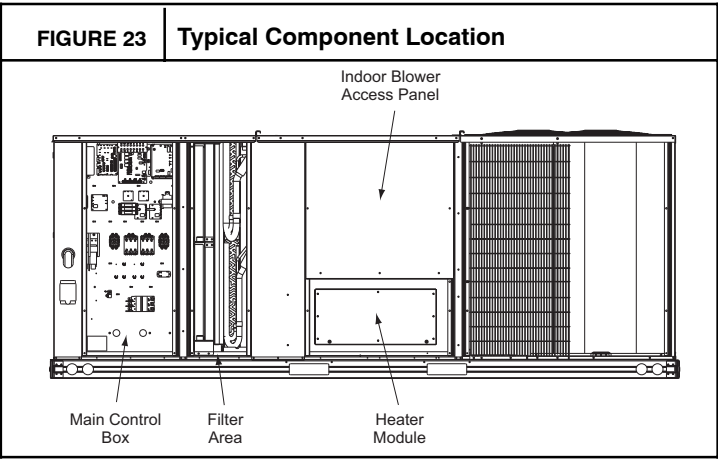


Not all available heater modules may be used in every unit. Use only those heater modules that are ETL listed for use in a specific size unit. Refer to the label on the unit cabinet for the list of approved heaters.

Unit heaters are marked with Heater Model Numbers. But heaters are ordered as and shipped in cartons marked with a corresponding heater Sales Package part number. See Table 2 for correlation between heater Model Number and Sales Package part number.

**NOTE:**The value in position 9 of the part number differs between the sales package part number (value is 1) and a bare heater model number (value is 0).



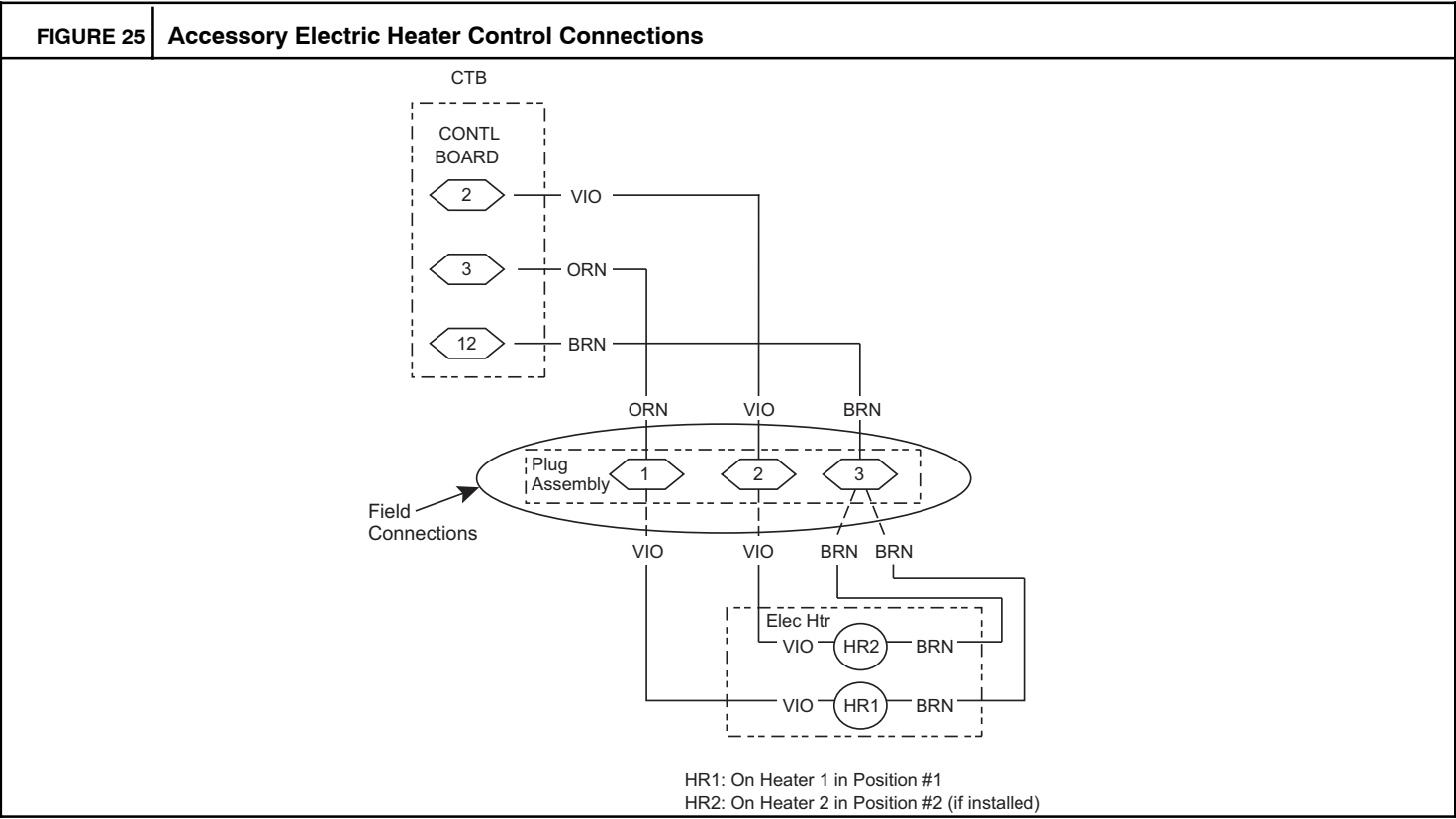


**Low-Voltage Control Connections —**

Locate the plug assembly in the electric heater section of the main unit. Connect the plug with the mating low voltage plug located on the heater.

**Table 2—Heater Model Number**

Bare Heater Model Number	C	R	H	E	A	T	E	R	0	0	1	A	0	0
Heater Sales Package PNO Includes: Bare Heater Carton and packing materials Installation sheet	C	R	H	E	A	T	E	R	2	7	9	A	0	0



## SMOKE DETECTORS

Smoke detectors are available as factory-installed options on RHS models. Smoke detectors may be specified for Supply Air only without or with economizer. All components necessary for operation are factory-provided and mounted. The unit is factory-configured for immediate smoke detector shutdown operation; additional wiring or modifications to unit terminal board may be necessary to complete the unit and smoke detector configuration to meet project requirements.

### System

The smoke detector system consists of a four-wire controller and one or two sensors. Its primary function is to shut down the rooftop unit in order to prevent smoke from circulating throughout the building. It is not to be used as a life saving device.

### Controller

The controller (see Fig. 26) includes a controller housing, a printed circuit board, and a clear plastic cover. The controller can be connected to one or two compatible duct smoke sensors. The clear plastic cover is secured to the housing with a single captive screw for easy access to the wiring terminals. The controller has three LEDs (for Power, Trouble and Alarm) and a manual test/reset button (on the cover face).

### Sensor

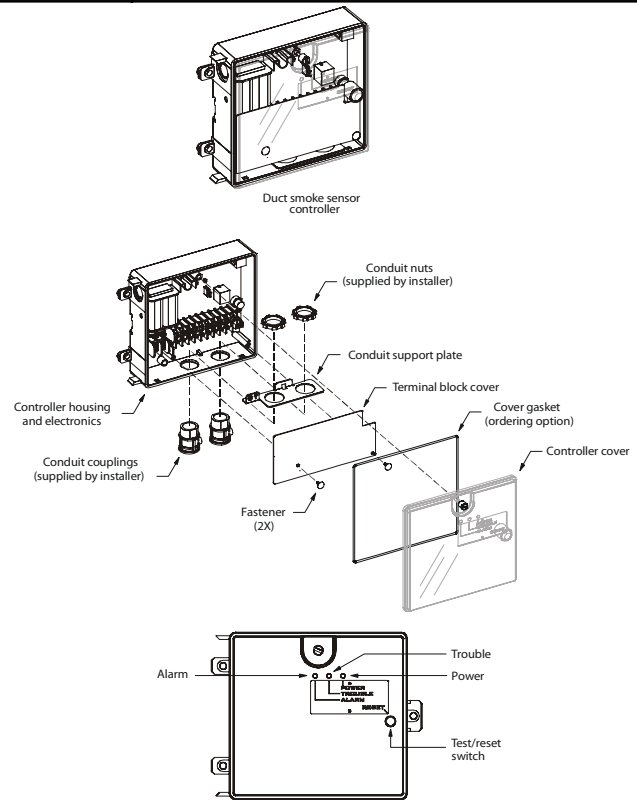
The sensor (see Fig. 27) includes a plastic housing, a printed circuit board, a clear plastic cover, a sampling tube inlet and an exhaust tube. The sampling tube (when used) and exhaust tube are attached during installation. The sampling tube is shipped in the blower section and is wire tied to the blower housing. See Fig. 28. The clear plastic cover permits visual inspections without having to disassemble the sensor. The cover attaches to the sensor housing using four captive screws and forms an airtight chamber around the sensing electronics. Each sensor includes a harness with an RJ45 terminal for connecting to the controller. Each sensor has four LEDs (for Power, Trouble, Alarm and Dirty) and a manual test/reset button (on the left-side of the housing).

Air is introduced to the duct smoke detector sensor's sensing chamber through a sampling tube that extends into the HVAC duct and is directed back into the ventilation system through a (shorter) exhaust tube. The difference in air pressure between the two tubes pulls the sampled air through the sensing chamber. When a sufficient amount of smoke is detected in the sensing chamber, the sensor signals an alarm state and the controller automatically takes the appropriate action to shut down fans and blowers, change over air handling systems, notify the fire alarm control panel, etc.

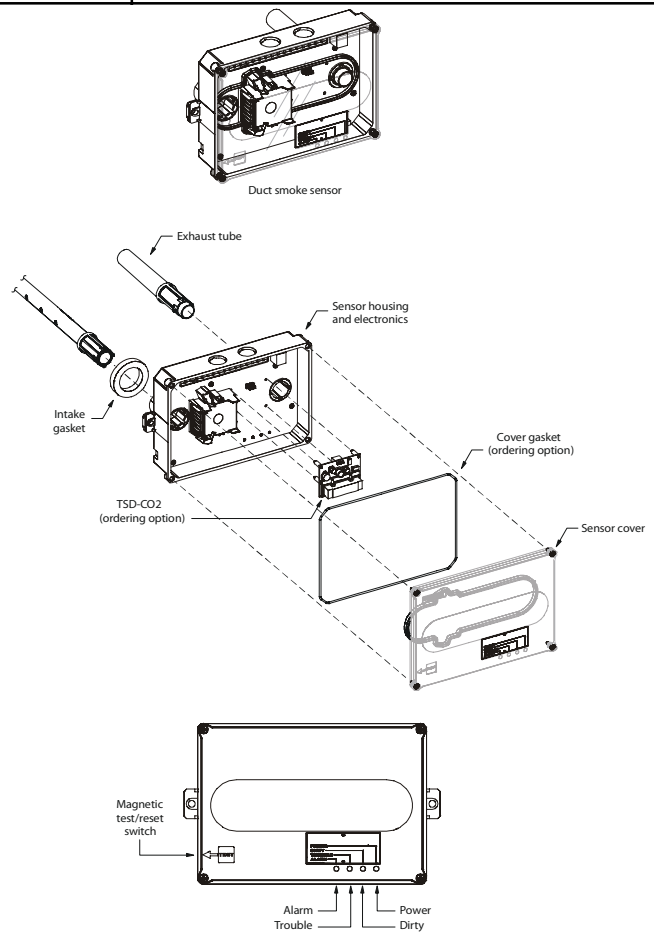
The sensor uses a process called differential sensing to prevent gradual environmental changes from triggering false alarms. A rapid change in environmental conditions, such as smoke from a fire, causes the sensor to signal an alarm state but dust and debris accumulated over time does not.

For installations using two sensors, the duct smoke detector does not differentiate which sensor signals an alarm or trouble condition.

**FIGURE 26 Controller Assembly**

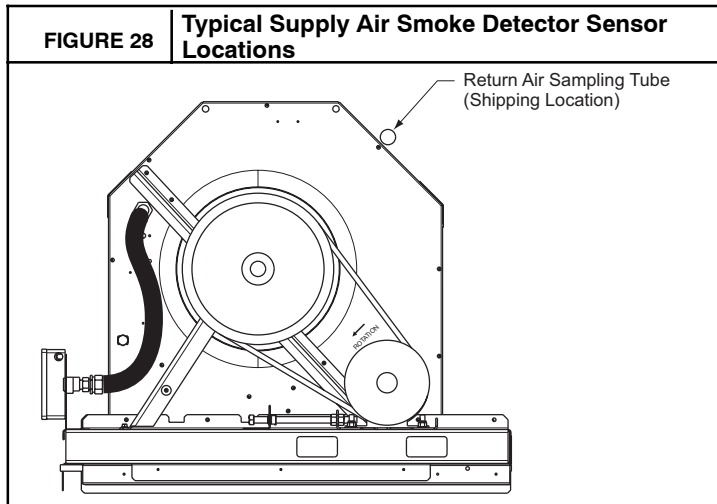


**FIGURE 27 Smoke Detector Sensor**



## Smoke Detector Locations

**Supply Air** — The Supply Air smoke detector sensor is located to the left of the unit's indoor (supply) fan. See Fig. 28. Access is through the fan access panel. There is no sampling tube used at this location. The sampling tube inlet extends through the side plate of the fan housing (into a high pressure area).



## Step 11 — Adjust Factory-Installed Options

### Smoke Detectors —

Smoke detector(s) will be connected at the Controls Connections Board, at terminals marked "Smoke Shutdown". Remove jumper JMP 3 when ready to energize unit.

## Economizer Occupancy Switch —

Refer to Fig. 29 for general Economizer wiring. External occupancy control is managed through a connection on the Central Terminal Board.

If external occupancy control is desired, connect a time clock or remotely controlled switch (closed for Occupied, open for Unoccupied sequence) at terminals marked OCCUPANCY on CTB. Remove or cut jumper JMP 2 to complete the installation.

## Step 12 — Install Accessories

Available accessories include:

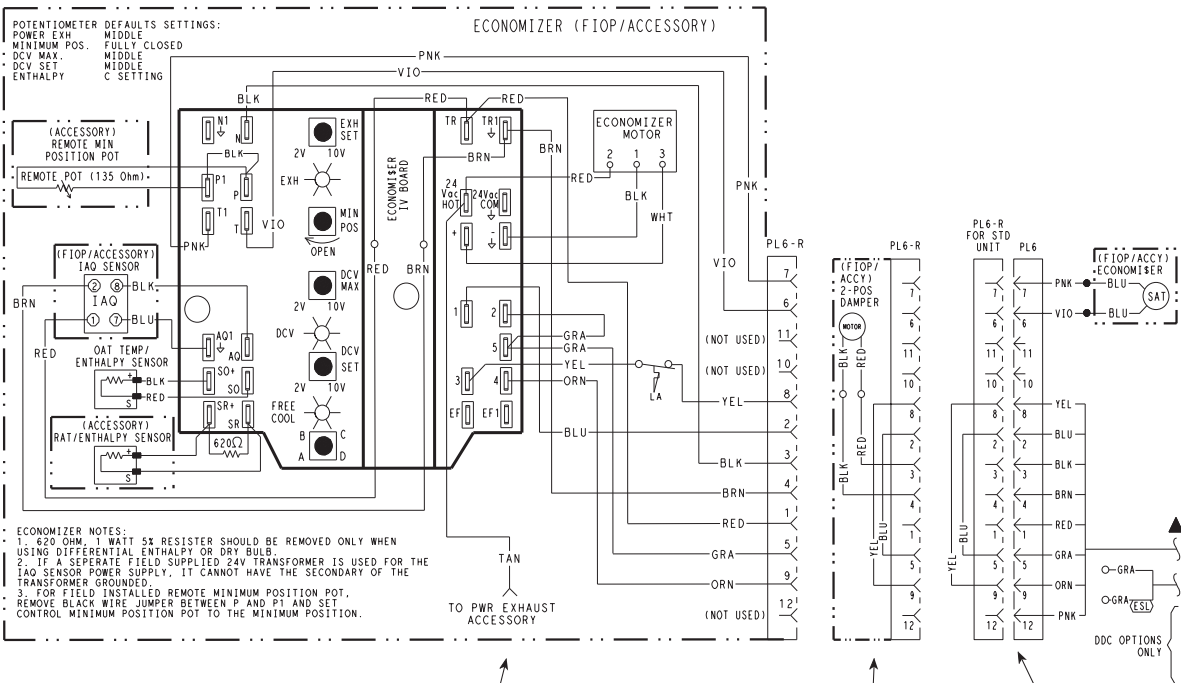
- Roof Curb
- Thru-base connection kit (must be installed before unit is set on curb)
- Manual outside air damper
- Low Ambient Controls
- Thermostat / Sensors
- Two-Position motorized outside air damper
- Power Exhaust
- Differential dry-bulb sensor (Economizer)
- Outdoor enthalpy sensor
- Differential enthalpy sensor
- Electric Heaters
- Single Point Kits
- CO<sub>2</sub> sensor
- Louvered hail guard
- Phase monitor control
- Winter Start kit

Refer to separate installation instructions for information on installing these accessories.

## Pre-Start and Start-Up

This completes the mechanical installation of the unit. Refer to the unit's Service Manual for detailed Pre-Start and Start-up instructions.

## Economizer Wiring



Economizer

## 2 Position Damper

Unit Without Economizer or  
2 Position Damper

**Table 3—Unit Wire/Fuse or HACR Breaker Sizing Data**

UNIT	NOM. V – Ph – Hz	IFM TYPE	ELEC. HTR			PE	NO C.O. or UNPWR C.O.							
			CRHEATER ***A00	Nom (kW)	FLA	FLA	NO P.E.				w/ P.E. (pwrdr fr/unit)			
							MCA	FUSE or HACR BRKR	DISC. SIZE		MCA	FUSE or HACR BRKR	DISC. SIZE	
									FLA	LRA			FLA	LRA
15 Ton	208/230 – 3 – 60	STD	NONE	-	-	5.9	68.3	90.0	71	393	80.1	100.0	85	413
			279A00	18.8/25.0	52.1/60.1		133.4/143.4	150/150	131/140	445/453	145.2/155.2	150/175	145/154	465/473
			280A00	37.6/50.0	104.2/120.3		198.5/188.6	200/200	191/210	497/513	210.3/200.4	225/225	205/223	517/533
			281A00	56.3/75.0	156.4/180.4		224.7/248.7	250/300	251/279	549/573	236.5/260.5	250/300	265/292	569/593
		MED	NONE	-	-	5.9	71.0	90.0	74	410	82.8	100.0	88	430
			279A00	18.8/25.0	52.1/60.1		136.1/146.1	150/150	134/144	462/470	147.9/157.9	150/175	148/157	482/490
			280A00	37.6/50.0	104.2/120.3		201.2/191.3	225/200	194/213	514/530	213.0/203.1	225/225	208/226	534/550
			281A00	56.3/75.0	156.4/180.4		227.4/251.4	250/300	254/282	566/590	239.2/263.2	250/300	268/295	586/610
		HIGH	NONE	-	-	5.9	75.8	100.0	80	419	87.6	100.0	93	439
			279A00	18.8/25.0	52.1/60.1		140.9/150.9	150/175	140/149	471/479	152.7/162.7	175/175	153/163	491/499
			280A00	37.6/50.0	104.2/120.3		206.0/196.1	225/225	200/218	523/539	217.8/207.9	225/225	213/232	543/559
			281A00	56.3/75.0	156.4/180.4		232.2/256.2	250/300	260/287	575/599	244.0/268.0	300/300	273/301	595/619
	460 – 3 – 60	STD	NONE	-	-	3.1	33.6	45.0	35	234	39.8	50.0	42	246
			282A00	25.0	30.1		71.2	80.0	70	264	77.4	80.0	77	276
			283A00	50.0	60.1		93.7	100.0	104	294	99.9	110.0	111	306
			284A00	75.0	90.2		123.8	150	139	324	130.0	150	146	336
		MED	NONE	-	-	3.1	35.0	45.0	37	243	41.2	50.0	44	255
			282A00	25.0	30.1		72.6	80.0	71	273	78.8	80.0	78	285
			283A00	50.0	60.1		95.1	100.0	106	303	101.3	110.0	113	315
			284A00	75.0	90.2		125.2	150	140	333	131.4	150	148	345
		HIGH	NONE	-	-	3.1	37.6	45.0	40	247	43.8	50.0	47	259
			282A00	25.0	30.1		75.2	80.0	74	277	81.4	90.0	81	289
			283A00	50.0	60.1		97.7	110.0	109	307	103.9	110.0	116	319
			284A00	75.0	90.2		127.8	150	143	337	134.0	150	151	349
	575 – 3 – 60	STD	NONE	-	-	2.4	24.9	30.0	26	184	29.7	35.0	32	192
			285A00	24.8	23.9		54.7	60.0	53	208	59.5	60.0	59	216
			286A00	49.6	47.7		84.5	90.0	81	232	89.3	90.0	86	240
			287A00	74.4	71.6		96.5	100	108	256	101.3	110	114	264
		MED	NONE	-	-	2.4	24.9	30.0	26	184	29.7	35.0	32	192
			285A00	24.8	23.9		54.7	60.0	53	208	59.5	60.0	59	216
			286A00	49.6	47.7		84.5	90.0	81	232	89.3	90.0	86	240
			287A00	74.4	71.6		96.5	100	108	256	101.3	110	114	264
		HIGH	NONE	-	-	2.4	27.7	30.0	29	198	32.5	40.0	35	206
			285A00	24.8	23.9		57.5	60.0	57	222	62.3	70.0	62	230
			286A00	49.6	47.7		87.3	90.0	84	246	92.1	100.0	90	254
			287A00	74.4	71.6		99.3	110	112	270	104.1	110	117	278

**NOTE:** See page 23 for table legend and notes

**Table 3: Unit Wire/Fuse or HACR Breaker Sizing Data (Cont.)**

UNIT	NOM. V – Ph – Hz	IFM TYPE	ELEC. HTR			PE	NO C.O. or UNPWR C.O.							
			CRHEATER ***A00	Nom (kW)	FLA	FLA	NO P.E.				w/ P.E. (pwrdr fr/unit)			
							MCA	FUSE or HACR BRKR	DISC. SIZE		MCA	FUSE or HACR BRKR	DISC. SIZE	
									FLA	LRA			FLA	LRA
20 Ton	208/230 – 3 – 60	STD	NONE	–	–	5.9	92.7	125.0	97	558	104.5	125.0	111	578
			279A00	18.8/25.0	52.1/60.1		157.9/167.9	175/175	157/166	610/618	169.7/179.7	175/200	171/180	630/638
			280A00	37.6/50.0	104.2/120.3		223.0/213.0	225/225	217/235	662/678	234.8/224.8	250/250	230/249	682/698
			281A00	56.3/75.0	156.4/180.4		249.1/273.1	300/300	277/305	714/738	260.9/284.9	300/300	290/318	734/758
		MED	NONE	–	–	5.9	90.5	100.0	95	560	102.3	125.0	108	580
			279A00	18.8/25.0	52.1/60.1		155.7/165.7	175/175	154/164	612/620	167.5/177.5	175/200	168/177	632/640
			280A00	37.6/50.0	104.2/120.3		220.8/210.8	225/225	214/233	664/680	232.6/222.6	250/250	228/246	684/700
			281A00	56.3/75.0	156.4/180.4		246.9/270.9	300/300	274/302	716/740	258.7/282.7	300/300	288/316	736/760
		HIGH	NONE	–	–	5.9	97.1	125.0	102	596	108.9	125.0	116	616
			279A00	18.8/25.0	52.1/60.1		162.3/172.3	175/175	162/171	648/656	174.1/184.1	175/200	176/185	668/676
			280A00	37.6/50.0	104.2/120.3		227.4/217.4	250/250	222/240	700/716	239.2/229.2	250/250	236/254	720/736
			281A00	56.3/75.0	156.4/180.4		253.5/277.5	300/300	282/310	752/776	265.3/289.3	300/300	296/323	772/796
	460 – 3 – 60	STD	NONE	–	–	3.1	50.1	60.0	52	288	56.3	70.0	60	300
			282A00	25.0	30.1		87.7	90.0	87	318	93.9	100.0	94	330
			283A00	50.0	60.1		110.2	125.0	122	348	116.4	125.0	129	360
			284A00	75.0	90.2		140.3	150	156	378	146.5	175	163	390
		MED	NONE	–	–	3.1	49.1	60.0	51	289	55.3	60.0	58	301
			282A00	25.0	30.1		86.7	90.0	86	319	92.9	100.0	93	331
			283A00	50.0	60.1		109.2	125.0	120	349	115.4	125.0	128	361
			284A00	75.0	90.2		139.3	150	155	379	145.5	150	162	391
		HIGH	NONE	–	–	3.1	52.4	60.0	55	307	58.6	70.0	62	319
			282A00	25.0	30.1		90.0	100.0	90	337	96.2	100.0	97	349
			283A00	50.0	60.1		112.5	125.0	124	367	118.7	125.0	131	379
			284A00	75.0	90.2		142.6	150	159	397	148.8	175	166	409
	575 – 3 – 60	STD	NONE	–	–	2.4	36.2	45.0	38	204	41.0	50.0	43	212
			285A00	24.8	23.9		66.1	70.0	65	228	70.9	80.0	71	236
			286A00	49.6	47.7		95.8	100.0	93	252	100.6	110.0	98	260
			287A00	74.4	71.6		107.8	125	120	276	112.6	125	126	284
		MED	NONE	–	–	2.4	35.7	45.0	37	193	40.5	50.0	43	201
			285A00	24.8	23.9		65.6	70.0	65	217	70.4	80.0	70	225
			286A00	49.6	47.7		95.3	100.0	92	241	100.1	110.0	98	249
			287A00	74.4	71.6		107.3	125	120	265	112.1	125	125	273
		HIGH	NONE	–	–	2.4	38.4	50.0	40	219	43.2	50.0	46	227
			285A00	24.8	23.9		68.3	70.0	68	243	73.1	80.0	73	251
			286A00	49.6	47.7		98.0	100.0	95	267	102.8	110.0	101	275
			287A00	74.4	71.6		110.0	125	123	291	114.8	125	128	299

**NOTE:** See page 23 for table legend and notes

Legend and Notes for Table 3

LEGEND:

- BRKR - Circuit breaker
- CO - Convenient outlet
- DD - Direct drive indoor fan motor
- DISC - Disconnect
- FLA - Full load amps
- IFM - Indoor fan motor
- LRA - Locked rotor amps
- MCA - Minimum circuit amps
- PE - Power exhaust
- PWRD CO - Powered convenient outlet
- UNPWR CO - Unpowered convenient outlet



NOTES:

- 1. In compliance with NEC requirements for multimotor and combination load equipment (refer to NEC Articles 430 and 440), the overcurrent protective device for the unit shall be fuse or HACR breaker. Canadian units may be fuse or circuit breaker.
- 2. **Unbalanced 3-Phase Supply Voltage**  
Never operate a motor where a phase imbalance in supply voltage is greater than 2%. Use the following formula to determine the percentage of voltage imbalance.

% Voltage Imbalance = 100 x  $\frac{\text{max voltage deviation from average voltage}}{\text{average voltage}}$

Example: Supply voltage is 230-3-60



- AB = 224 v
- BC = 231 v
- AC = 226 v

Average Voltage =  $\frac{(224 + 231 + 226)}{3} = \frac{681}{3}$   
= 227

Determine maximum deviation from average voltage.

(AB) 227 - 224 = 3 v

(BC) 231 - 227 = 4 v

(AC) 227 - 226 = 1 v

Maximum deviation is 4 v.

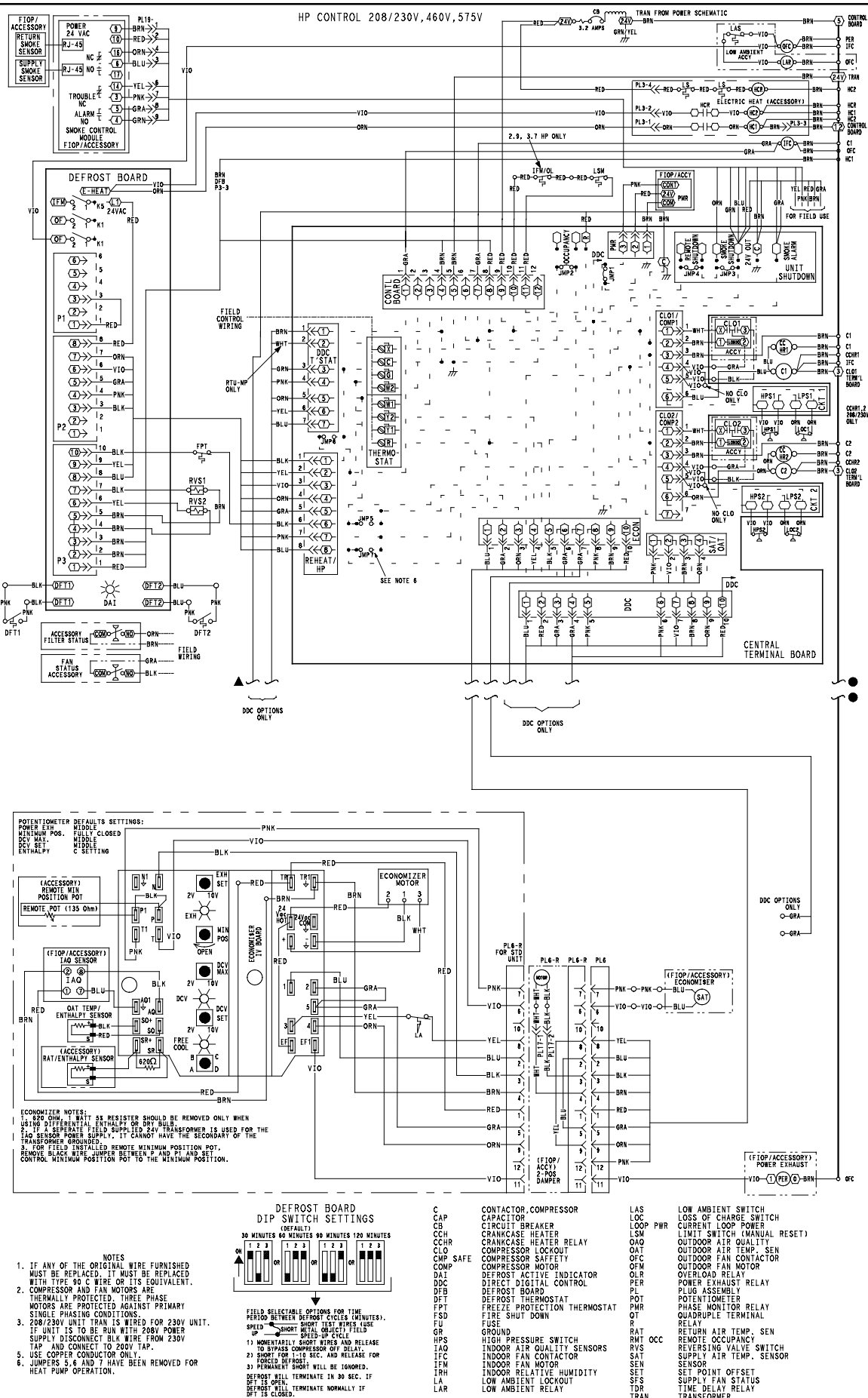
Determine percent of voltage imbalance.

% Voltage Imbalance = 100 x  $\frac{4}{227}$   
= 1.76%

This amount of phase imbalance is satisfactory as it is below the maximum allowable 2%.

**IMPORTANT:** If the supply voltage phase imbalance is more than 2%, contact your local electric utility company immediately.

FIGURE 30 Typical Wiring Diagrams - HP Control 460V, 575V 3 Phase





**FIGURE 31** Typical Wiring Diagrams - HP Power 460V, 575V 3 Phase

